CLAIMS

1.   A method of estimating a time to collision (TTC) of a vehicle with an object comprising:

        acquiring a plurality of images of the object; and

        determining a TTC from the images that is responsive to a relative velocity and relative acceleration between the vehicle and the object.

2.   A method according to claim 1 and comprising determining the relative velocity or a function thereof from the images and using the relative velocity or function thereof to determine TTC.

3.   A method according to claim 2 wherein determining the relative velocity or function thereof, comprises determining a change in scale of an image of at least a portion of the object between images of the pluralities of images and using the change in scale to determine the relative velocity or function thereof.

4.   A method according to claim 2 or claim 3 and comprising determining the relative acceleration or a function thereof from the images and using the relative acceleration or function thereof to determine TTC.

5.   A method according to claim 4 wherein determining the relative acceleration or function thereof comprises determining a time derivative of the relative velocity or the function of the relative velocity.

6.   A method according to any of the preceding claims wherein TTC is determined only from information derived from the images.

7.   A method according to any of the preceding claims and comprising determining whether the vehicle and the object are on a course that leads to a collision at the TTC.

8.   A method according to claim 7 wherein determining whether the vehicle and object are on a collision course comprises:

determining motion of at least two features of the object relative to the vehicle from the images; and

determining from the relative motions whether at TTC the first and second features straddle at least a part of the vehicle.

9.   Apparatus for determining a time to collision (TTC) of a vehicle with an object comprising:

at least one camera mounted in the vehicle and adapted for acquiring images of objects in the environment of the vehicle; and

a processor that receives image data from the camera and processes the data to determine a TTC in accordance with any of claims 1-8.

10.   Apparatus according to claim 9 wherein the at least one camera comprises a single camera.

11.   Apparatus according to claim 9 or claim 10 and comprising alarm apparatus for alerting a driver of the vehicle to a possible collision with the object responsive to the TTC.

12.   Apparatus according to any of claims 9-11 and comprising alarm apparatus for alerting persons outside of the vehicle to a possible collision of the vehicle with the object responsive to the TTC.

13.   Apparatus according to any of claims 9-12 wherein the at least one camera images an environment in front of the vehicle.

14.   Apparatus according to any of claims 9-13 wherein the at least one camera images an environment in back of the vehicle.

15.   Apparatus according to any of claims 9-14 wherein the at least one camera images an environment to a side of the vehicle.

16.   A method of determining whether a first object and a second object are on a collision course comprising:

acquiring an image of the second object from a position of the first object at each of a plurality of known times;

determining motion of at least two features of the first object relative to the second object from the images;

determining an estimate of a possible time to collision (TTC) of the first and second objects; and

determining from the relative motions whether at the TTC, the first and second features straddle at least a part of the vehicle and if so that the objects are on a collision course.

17.   A method according to claim 16 wherein determining motion of the at least two features comprises determining lateral motion of the features relative to the first object.

18.   A method according to claim 17 wherein determining whether the features straddle the first object at the TTC comprises extrapolating lateral locations of the features at TTC from their motion at times at which the images are acquired.

19.   A method according to claim 18 wherein determining TTC comprises determining TTC from the images.

20.   A method according to claim 19 and determining TTC only from the images.

21.   A method of determining relative acceleration between a first and second object comprising:

acquiring a plurality of images of the second object from locations of the first object;

determining a change in scale of an image of at least a portion of the second object between images of the pluralities of images;

using the change in scale to determine acceleration of a function of the acceleration.

22.   A method according to claim 21 wherein the acceleration or function thereof is determined only from data in the images.